disadvantages of the intelligent network technology far outweigh the cost advantages for basic service, and the economic impact of the deployment of these technologies will be to raise total costs considerably. In the past, combinations of cost reduction and revenue growth resulting from the introduction of new services permitted overall price declines, cushioning the burden of cost misallocation, but that is unlikely to occur with intelligent network services. The costs are so large, the benefits are so heavily concentrated in specialized services and the demand for those services is so uncertain that the possibility of price reductions is very small.

Unfortunately, state commissions have not adopted appropriate approaches to allocate the costs of intelligent network services under their jurisdiction. The report urges regulators to recognize that the incentives for creating the new plant are solely directed to meeting the needs of new and premium services. Consequently, they will need to develop allocation methods that consider the cost impacts of premium services.

TABLE ES-1

THE IMPACT OF PREMIUM SERVICES ON LOCAL EXCHANGE PLANT

		Melding Long Distance and Local	Conversion to Direct Distance Dialing	Conversion to the Intelligent Network
PROBLEM	What technical problems does the provision of a particular service create?	Signal attenuation results in separate networks which cause inconvenience	Cumbersome and inconvenient operator interconnection	Slow, noisy voice network inhibits broad deployment of advanced services
TECHNICAL SOLUTION:				
Network Organization	Who talks to whom and how is that connection established?	Integration of local and long distance	Ubiquitous direct user interconnection	Transform voice network into digital network
Transmission	What is the medium over which the communication is sent?	Grounded cable to metallic cable with loading coil and repeaters (1890-1910); staggered twisted pair (late 1920s)	[Open wire/FM to coaxial cable, satellite, microwave]*	[Broadband fiber optic cable and T-1 carrier]
Switching	How are messages routed between subscribers?	Manual ringdown	Automatic analog	Digital
Signaling	How is the status of the system indicated to control the flow of traffic?	Manual D.C. loop in-band	A.C., E&M and SF in-band	Out-of-band SS7
Numbering	How are messages addressed?	7-digit	10-digit	11 to 15-digit
Accounting	How are accounts identified and transactions recorded?	Manual	Automatic accounting	[Computerized]
COST	How much does it cost to deploy the necessary equipment?	35 percent increase in local exchange plant	43 percent increase in central office equipment	Hundreds of billions
REGULATORY RESPONSE	How do regulators treat the increased cost?	Federal: Nominal	Station-to-station allocates weighted cost to long distance but is 90% local	Subscriber line charge, joint cost order -- 90% local
		State: generally none	Value of service residual pricing, intra/interstate rate equalization	Few have policy. Some have abandoned basic economic tests
PRICE IMPACT	How do prices reflect regulatory decisions?	1900-1940: local up 33%; long distance: short haul down 20% long haul down 65%	1949-1959: local up 27% long distance: interstate up 6% intrastate up 13%	Unknown

* Entries in brackets are not discussed in this paper but are an important part of the ongoing debate over the deployment of intelligent network services.

I. INTRODUCTION, ANALYTIC FRAMEWORK, OVERVIEW AND POLICY RECOMMENDATIONS[1]

A. Introduction

Throughout its history, the design of local exchange plant facilities has undergone successive transformations to meet the needs of premium communication services which utilize this plant in common with the provision of basic service.

* The development of long distance (toll) service and its integration with local service and the abandonment of separate local and toll networks was one such instance.

* The evolution of message toll from manual, to operator-assisted service, to fully automatic, customer-dialed handling was another step in the progress of telephony.

* Today, the provision of information services over local exchange facilities and the abandonment of separate voice, data and video networks mirrors earlier patterns of the development of premium services.

While the historical process of this development is well known, the extent to which the costs of this transformation were borne by basic exchange ratepayers is barely recognized.

B. Purpose and Analytic Framework

1. Purpose

The purpose of this paper is to examine the impact of the provision of premium services on the technical design, operation, and cost of local exchange plant and implications of their provision for local rates. It begins with historical examples to gain a better understanding of the process of change, but the primary focus of the report is on contemporary technological changes ongoing in the telephone network.

This paper does not offer a prescription for the 'best' method of cost allocation, nor does it seek to present an exhaustive compendium of technological change in the past century. Rather, it seeks to address a prior and perhaps more fundamental issue. It seeks to establish the factual basis for insisting on a careful cost causative analysis of technological change in the first place. It does so by reviewing repeated instances of major technological changes throughout the history of the industry in which the failure to engage in sound cost causative analysis led to serious misallocation of costs to basic local exchange service. The issue has

[1]Dr. Mark N. Cooper provided a major contribution to the analytic framework in this chapter.

never been whether or not to permit technology, the question has always been who pays for it.

This chapter first provides an analytic framework for understanding technological change in the telecommunications industry, and then briefly applies this model to three case studies: the integration of long distance into the local exchange network; the conversion of the local exchange network to direct distance dialing; and the conversion of the local exchange network to the Intelligent Network. Chapters II and III develop the model more fully. Table I-2 provides a detailed summary of the model.

2. Analytic framework for understanding technological change

The most exacting requirements of the most exacting (premium) service are the drivers of cost in the telecommunications network. In order to understand the impact of premium services it is necessary to consider how the addition of premium services has interacted with and been determined by technical, economic, and regulatory constraints.

The history of technological change in the telecommunications industry can be broken down into five steps, which are roughly sequential (see Table I-1).

1) Problem: What functions do people or companies want the telephone network to perform? What operational characteristics do the functions require?

2) Technical Solution: How does the system work in order to get the job done? What are the design considerations (solutions) that drove the changes in the network?

3) Cost Implication: What capital costs does the technology require? How much does it cost?

4) Regulatory Response: How do federal and state regulators identify costs and allocate them for recovery in rates?

5) Price Impact: Who pays? How do price trends during the period of technological change reflect regulatory decisions?

For each of the major changes in the industry studied in this paper, all five of the above steps are considered. Special attention is given to step 2, the technical changes necessitated by the addition of premium services. For each major change in the telecommunications network that is studied, the impact of the addition of new services on one or more of the key technical building blocks of a telecommunications network is examined. These are the things a telecommunications network has to do in order to function. A technological change will

TABLE I-1

FRAMEWORK FOR ANALYZING TECHNOLOGICAL CHANGE IN THE TELECOMMUNICATIONS INDUSTRY

PROBLEM ↓	WHAT TECHNICAL PROBLEMS DOES THE PROVISION OF A PARTICULAR SERVICE CREATE?
TECHNICAL SOLUTION ↓	WHAT EQUIPMENT OR ORGANIZATIONAL CHANGES ARE MADE TO OVERCOME THOSE PROBLEMS? Network Organization: Who talks to whom and how is that connection established? Transmission: What is the medium over which the communications are sent? Switching: How are messages from one subscriber to another subscriber routed? Signaling: How is the status of the system indicated for purposes of controlling the flow of traffic? Numbering: How are messages addressed so that they can get to their destination? Management of accounting: How are accounts identified and transactions recorded for billing purposes?
COST IMPLICATION ↓	HOW MUCH DOES IT COST TO EFFECTUATE THE CHANGE AND DEPLOY THE NECESSARY EQUIPMENT?
REGULATORY RESPONSE ↓	HOW DO REGULATORS TREAT THE INCREASED COST (OR REVENUE) THAT FLOWS FROM THE SOLUTION?
PRICE IMPACT	HOW DO THE CHARGES FOR VARIOUS SERVICES REFLECT REGULATORY DECISIONS?

not have a significant impact on the network if it does not significantly affect one or more of these building blocks:

* Network Organization: The basic way a system is set up and the users of the system interact.

* Transmission: The medium over which the communications is sent.

* Switching: The manner in which traffic finds its way from origin to destination.

* Signaling: The manner in which the status of the system is indicated for purposes of controlling the flow of traffic.

* Numbering: The way messages are addressed so that they can get to their destination.

* Management of accounting: Provision for system management to allow billing, etc.

Table I-2 summarizes the results of the model (the same table also appears in the Executive Summary).

3. The importance of cost causation analysis

This paper is based on the premise that in order to answer the fundamental question of regulation "who should pay?" -- one must understand how the telephone system is designed. One must know what causes costs to be incurred and which services benefit from the deployment of specific pieces of costly capital equipment.

This cost causative analysis is necessary for both economic and equity reasons. If costs are not properly attributed to the services which cause them, prices will not be properly set. If prices are not set to properly reflect costs, resources will be misallocated and income will be transferred from the subscribers of the overpriced service to the subscribers of the under-priced service.

Thus, pricing which is not based on good cost causative analysis is both inefficient and unfair. The fact that cost allocation in a complex network like the telephone system is difficult is not an excuse to neglect cost causative analysis; it is a reason to expend even greater effort on this crucial task.

TABLE I-2

THE IMPACT OF PREMIUM SERVICES ON LOCAL EXCHANGE PLANT

		MELDING LONG DISTANCE AND LOCAL	CONVERSION TO DIRECT DISTANCE DIALING	CONVERSION TO THE INTELLIGENT NETWORK
PROBLEM	WHAT TECHNICAL PROBLEMS DOES THE PROVISION OF A PARTICULAR SERVICE CREATE?	SIGNAL ATTENUATION RESULTS IN SEPARATE NETWORKS WHICH CAUSE INCONVENIENCE	CUMBERSOME AND INCONVENIENT OPERATOR INTERCONNECTION	SLOW, NOISY VOICE NETWORK INHIBITS BROAD DEPLOYMENT OF ADVANCED SERVICES
TECHNICAL SOLUTION:				
NETWORK ORGANIZATION	WHO TALKS TO WHOM AND HOW IS THAT CONNECTION ESTABLISHED?	INTEGRATION OF LOCAL AND LONG DISTANCE	UBIQUITOUS DIRECT USER INTERCONNECTION	TRANSFORM VOICE NETWORK INTO DIGITAL NETWORK
TRANSMISSION	WHAT IS THE MEDIUM OVER WHICH THE COMMUNICATION IS SENT?	GROUNDED CABLE TO METALLIC CABLE WITH LOADING COIL AND REPEATERS (1890-1910); STAGGERED TWISTED PAIR (LATE 1920S)	[OPEN WIRE/FM TO COAXIAL CABLE, SATELLITE, MICROWAVE]*	[BROADBAND FIBER OPTIC CABLE AND T-1 CARRIER]
SWITCHING	HOW ARE MESSAGES ROUTED BETWEEN SUBSCRIBERS?	MANUAL RINGDOWN	AUTOMATIC ANALOG	DIGITAL
SIGNALING	HOW IS THE STATUS OF THE SYSTEM INDICATED TO CONTROL THE FLOW OF TRAFFIC?	MANUAL D.C. LOOP IN-BAND	A.C., E&M AND SF IN-BAND	OUT-OF-BAND SS7
NUMBERING	HOW ARE MESSAGES ADDRESSED?	7-DIGIT	10-DIGIT	11 TO 15-DIGIT
ACCOUNTING	HOW ARE ACCOUNTS IDENTIFIED AND TRANSACTIONS RECORDED?	MANUAL	AUTOMATIC ACCOUNTING	[COMPUTERIZED]
COST	HOW MUCH DOES IT COST TO DEPLOY THE NECESSARY EQUIPMENT?	35 PERCENT INCREASE IN LOCAL EXCHANGE PLANT	43 PERCENT INCREASE IN CENTRAL OFFICE EQUIPMENT	HUNDREDS OF BILLIONS
REGULATORY RESPONSE	HOW DO REGULATORS TREAT THE INCREASED COST?	FEDERAL: NOMINAL	STATION-TO-STATION ALLOCATES WEIGHTED COST TO LONG DISTANCE BUT IS 90% LOCAL	SUBSCRIBER LINE CHARGE, JOINT COST ORDER -- 90% LOCAL
		STATE: GENERALLY NONE	VALUE OF SERVICE RESIDUAL PRICING, INTRA/INTERSTATE RATE EQUALIZATION	FEW HAVE POLICY. SOME HAVE ABANDONED BASIC ECONOMIC TESTS
PRICE IMPACT	HOW DO PRICES REFLECT REGULATORY DECISIONS?	1900-1940: LOCAL UP 33% LONG DISTANCE: SHORT HAUL DOWN 20% LONG HAUL DOWN 65%	1949-1959: LOCAL UP 27% LONG DISTANCE: INTERSTATE UP 6% INTRASTATE UP 13%	UNKNOWN

* Entries in brackets are not discussed in this paper but are an important part of the ongoing debate over the deployment of intelligent network services.

4. Common local exchange plant and local telephone service

To aid the analysis of cost causation, it is extremely important to emphasize the distinction between basic local telephone service and the common local exchange plant.

* Basic local telephone service is simply voice telephone connections within a specifically defined local service area.

* Common local exchange plant is comprised of those facilities that are physically located within the local area, but are used to supply both the basic and the premium services in common.

The local exchange facilities are common facilities for the different kinds of services that are provided over them. When we say that a facility is common, it simply means that it is utilized by many service classifications. For example, the local loop normally consists of a metallic wire pair which connects the subscriber to his local central office. The subscriber originates and receives local exchange calls, intrastate message toll calls, interstate message toll calls and various forms of data traffic. Each of these service classifications utilizes the local loop as common plant.

The engineering design standards and the investment and expenses incurred for local exchange plant are determined by the variety of uses to which those facilities will be put. When exchange plant is engineered, it is done in such a way as to accommodate the most exacting requirements of the most exacting (premium) services which utilize these facilities.

C. Case Studies

1. Introduction

For many years regulators have accepted telephone company arguments that local exchange telephone service has been subsidized by revenues generated by long distance services. The history of the development and operation of the industry indicate otherwise. That history is characterized by four interrelated themes:

* Basic local exchange plant is generally simple to design and relatively inexpensive to operate and maintain. The services that can be offered over basic local exchange plant are also relatively simple, e.g. plain old (voice) telephone service (POTS).

* Over time, telephone companies have offered more complex, premium services such as long distance services over local exchange facilities.

* The effort to accommodate the technical requirements of the more complex, long distance services has imposed numerous and frequently expensive modifications of otherwise inexpensive local exchange facilities.

* Rate regulators did not properly attribute the costs of those expensive modifications to the services which demanded them. By assigning the increased cost to basic local service, rather than to the services which caused them, they created the illusion that local service did not pay its fair share. In fact, it was carrying a larger share of the costs than the benefits it derived from the technological advances.

The story of long distance cost allocation might be just a quaint vignette of ancient history, if history did not have a troubling way of repeating itself. Today we stand on the verge of another major effort to reconfigure the telephone network to accommodate a much more varied mix of premium services.

Video and data services reflect fundamentally different types of service, each of which imposes additional technical standards and costs on the local telecommunication system. For example, data communication requires different, higher quality signals because computers cannot filter out noise on the line that the human ear filters out in the normal auditory process. In addition, both video and data generally require much more speed and carrying capacity (bandwidth) than voice in order for transmission to be fully effective.

The present public switched telephone network was engineered for voice-grade services, driven by the costs of long distance service. While the existing network structure is perfectly satisfactory for this purpose, it is unsatisfactory for transmission of medium and high-speed data. Hence, it is being converted from voice (analog) to digital at an accelerating rate to accommodate the higher technical requirements of data services (Freeman, 1989 and Crowley, 1962).

Local exchange plant will again be used as a common facility to supply local telephone service and an increasing variety of "premium" services that impose increased costs on the common local exchange plant. If the costs of those services are again misallocated to local telephone service, history will repeat itself. By most estimates, the stakes are huge. In the next several decades hundreds of billions of dollars will be spent upgrading the network from a focus on voice uses to a focus on data and video uses.

Appropriate allocation of these costs has become more critical because the current round of technology deployment is fundamentally different than in prior periods. In the past, combinations of cost reduction and demand growth could quickly cushion the burden of cost misallocation, but that is highly unlikely in the intelligent network. The costs are so large, the benefits so heavily concentrated in specialized services and the demand for those service so uncertain that the near to mid-term possibility of price reductions is very small.

2. Integrating long distance into the local exchange network

At the very beginning of the telecommunications industry, local and long distance service were delivered over separate networks. The technical problem was that sending telephone signals over long distances was considerably more difficult than telecommunications over shorter local distances. As a result, two different technologies were utilized. Local service was delivered to the home of individual subscribers over a single wire. Long distance service was offered between telephone company central offices over two wires.

Integrating the two systems greatly improved the convenience of long distance service, but it also imposed heavy costs on local exchange plant, since that plant had to be upgraded to meet the demands of long distance communications. The costs of this change were imposed almost entirely on local customers, rather than long distance customers. The local exchange companies and their customers were used both to absorb the costs of long distance service and to undercut competing independent telephone companies.

The price changes over this period reflected the preferential treatment afforded to long distance service, in spite of the high demands it placed on the network. While the price of local service increased from the early twentieth century until World War II, long distance rates declined steadily. Between 1900 and 1940 local rates increased by over 30 percent, while long distance rates declined by over 60 percent (see Table II-2). The reduction in charges for long distance rates can be attributable only in part to the enormous improvements in interexchange technology that occurred over this time period.

3. The conversion to direct distance dialing

The image of rows of operators plugging and unplugging telephone lines to complete calls is a classic telephone industry symbol. The interaction with the operator was cumbersome, requiring the caller to say who he or she wanted to call and then waiting for the operator to connect through to another operator who would ring the desired number.

Without major technological changes, however, this interaction was unavoidable because a great deal of work was done by the operator. The manual functions performed by the switchboard operator included trunk selection, signaling, timing and ticketing of calls. These functions had to be supplanted by various mechanized processes for direct subscriber interconnection to be achieved. An additional, and perhaps more interesting requirement, was the introduction of a uniform, nationwide numbering system.

Thus, enormous changes and improvements in the makeup and design of local exchange plant were necessary prior to the introduction of Direct Distance Dialing (DDD). Five requisites had to be met in order for direct distance dialing to be achieved:

* Conversion to local dial services,

* Mechanization of billing and accounting,

* Modification of the signaling system,

* Improvement in switching equipment, and

* Development of a uniform numbering system.

All of these requisites to DDD had major cost impacts. Although these were largely improvements necessitated by long distance (toll) service, the bulk of the additional costs were borne by local exchange ratepayers. Although court cases had led to the use of more sophisticated cost allocation formulas by the time of this conversion, these allocation formulas still placed the overwhelming majority of the burden on local ratepayers.

Consistent price data is available for the period of conversion from manual to Direct Distance Dialing. Although, expensive technical changes to implement DDD were the critical factor driving costs in the industry during the years 1949-1960, the price of basic local service rose by 27 percent between 1949 and 1959, while interstate long distance (toll) rates increased by only 6 percent and state toll rates by 13 percent.

4. The Intelligent Network

The changes necessary to achieve an Intelligent Network are even more demanding than those involved in DDD. The current telephone network has been "optimized" for voice service. Moving data or video is quite another matter. From the point of view of a data network, the voice network is noisy, slow and relatively narrow.

The demands of data communication are fundamentally different than the demands of voice. Some key differences are described below

DELAY SENSITIVITY

Voice: High Sensitivity -- Silence in human conversation conveys information so that the voice network cannot add (or remove) periods of silence.

Data: Low Sensitivity -- Most data do not alter in meaning if they are delayed in the network for a few seconds; a packet containing temperature information for the Chicago airport will not change in meaning because of the addition or removal of a short delay in the network.

HOLDING TIME:

Voice: Long -- Telephone calls usually last for a relatively long time compared to the time necessary to set up the call. While it may take 3 to 11 seconds to set up a telephone call, the average local call lasts for about 180 seconds (3 minutes) and a toll call for about 300 seconds (5 minutes).

Data: Short -- Most data traffic is bursty; i.e., the bulk of the data is transmitted in a short period of time, such as checking on a credit card (interactive applications). A 90-10 rule is often cited to demonstrate this: 90 percent of the data is transmitted in 10 percent of the time. Since data transmission will tend to be very fast, long call setup time provides inefficient networks for data service in contrast to voice transmission.

FREQUENCY

Voice: Narrow -- A 3.1 khz passband is sufficient for human voice. Increasing the bandwidth available for the voice call does not affect the duration of the call.

Data: Wide -- Data can use all of a channel's available bandwidth. If additional bandwidth is made available for a data call, the duration of the call can decrease while the speed of transmission can increase. The wider spectrum for voice traffic with its long conversation times becomes an inefficient and redundant use of plant. Data networks operate efficiently at 64 khz.

The limitation of the analog network for premium services can be summarized by noting that it takes over two minutes to send a page of facsimile over an analog network, while it takes about 5 seconds to send it on a digital network.

Converting the telephone infrastructure from voice to data or video is a massive undertaking. The telephone companies propose deploying an Integrated Services Digital Network (ISDN) composed of:

* Fiber optic cable.

* Digital switches.

* An entirely new signaling system (SS7).

The cost and complexity are commensurate with the size of the undertaking. Although it is difficult to know precisely how much the overall cost will be, it is clear that it will be in the hundreds of billions of dollars (Wigand, 1988).

These technologies will raise the cost of providing service. Given these large costs, only increased revenue can hope to make the technologies a net economic benefit to the overall network. Future revenues cannot be credibly projected, however. Independent analysts have predicted that voice communications will continue to generate the greatest portion of ISDN traffic (Strock, 1989, 180 and Finneran, 1991). The vast majority of users will benefit little, but they will bear the costs unless costs are allocated appropriately.

D. Policy Conclusion: Protect Local Exchange Customers

The current replacement of voice-grade (analog) facilities by digital switching and transmission are analogous to the events at the turn of the century when local and long distance were integrated. Consolidation of local exchange and long distance facilities introduced economies of scope in the early days of the industry. But the costs of consolidation were largely borne by local exchange ratepayers, while the benefits accrued to the toll customers.

Policymakers are confronted by a parallel question today as the industry seeks to further modify local exchange plant as part of the desire to accommodate high-speed data and broadband service classifications. POTS customers will receive few service benefits from the development of digital facilities.

The urgency of the policy problem is underscored by the current status of the deployment of intelligent network technologies. The telephone companies have not yet significantly deployed SS7 and ISDN, but they are on the verge of doing so on a very large scale. The Bell Operating Companies (BOCs) are proposing to integrate their conventional local exchange plant digital facilities with independent high-speed data and information networks and accelerate the deployment of these integrated facilities. The BOCs and the major interexchange carriers completed limited ISDN trials in 1990. Almost all major PBX manufacturers that market in the United States have indicated that ISDN-compatible products are either available or under development.

Table I-3 reports the number of Bell Operating Company central offices equipped for ISDN and SS7 service and the number of equipped access lines for the years 1987 and forecast through 1994. It is clear that midway into the 1990 decade ISDN development will continue to be at the periphery of BOC operations. Because new services made possible by SS7 have greater potential to enhance revenues than ISDN-based services, which have yet to generate customer interest, the BOCs have moved more rapidly with the installation of SS7 than ISDN.

TABLE I-3

CENTRAL OFFICES (COs) AND LINES EQUIPPED FOR ISDN AND SS7
BELL OPERATING COMPANIES: 1987-1994

	ISDN						SS7					
	Central Offices			Telephone Lines			Central Offices			Telephone Lines		
Year	Total	ISDN	% ISDN	Lines	ISDN	% ISDN	Total	SS7	% SS7	Total	SS7	% SS7
1987	9,237	4	0.0	96,654	1	0.0	9,237	29	0.3	96,654	1,035	1.1
1988	9,348	82	0.9	99,524	43	0.0	9,348	435	4.7	9,524	10,325	10.4
1989	9,389	179	1.9	102,648	99	0.1	9,389	950	10.1	102,648	21,555	21.0
1990	9,406	426	4.5	105,844	496	0.5	9,406	2,083	22.1	105,844	36,706	34.7
1991	9,393	1,595	17.0	109,228	1,059	1.0	9,393	3,087	32.9	109,228	52,250	47.8
1992	9,373	1,764	18.8	112,476	1,370	1.2	9,373	4,101	43.8	112,476	66,394	59.0
1993	9,375	1,962	20.9	115,700	1,888	1.6	9,375	4,895	52.2	115,700	78,645	68.0
1994	9,366	2,269	24.2	118,961	2,218	1.9	9,366	5,362	57.2	118,961	86,964	73.1

Note: 1987-88 Actual; 1989-94 Projected

Source: CC Docket89-264, Initial Submission, Attachment B, Table 104, Federal Communications Commission

Still, SS7 has developed slowly to date. At the end of 1988, only about 10 percent of the RBOC's lines had access to the new signaling system. But, according to telephone company projections made in 1989, growth will occur rapidly beginning in 1990. By year-end 1994, the carriers expect that nearly three-fourths of their lines will be accessible to SS7.

With costs about to be incurred, there is certain to be a major round of debate over cost allocation and cost causation. Regulators can greatly affect the deployment of the technology and the impact that it has on rates for basic and premium services.

The potential benefits of ISDN and SS7 may be great, but most of these benefits will be realized for new services, not basic service, and will not be realized until many years into the future, if at all. Yet, to obtain these benefits, the telephone companies must undertake substantial up-front investment in new network technology and prematurely retire existing analog facilities. Both economic efficiency and equity dictate that the costs of new investment should be borne by those who benefit by its application. As demonstrated in Chapter III, it is unlikely that the cost advantages of ISDN and SS7 will outweigh their disadvantages, at least until both are universally deployed, decades into the future.

By and large, the state regulatory commissions have not developed methods permitting the proper allocation of the costs of intelligent network services. Some state commissions have removed competitive services which utilize SS7 and ISDN from their regulatory scope. Approaching policy issues from the perspective of individual services is appropriate for some policy issues, such as determining the competitive status of various services, but it is not an appropriate way to approach the allocation of costs associated with SS7 and ISDN. ISDN and SS7 are new network concepts, not singular services. These network facilities will not only offer the established voice, data and video services available today, but will also provide as yet unknown future services as software develops.

The job of protecting the basic ratepayer has become increasingly complex. But no tenable solution is possible until regulators understand and carefully consider the problem. The commissions should recognize that the incentives for creating the new plant are solely directed to meeting the needs of new and premium services and that basic local exchange services should be insulated from any cost effects.

Rather than attempt elaborate cost allocation schemes on a service-by-service basis, commissions should consider allocating costs on the basis of generic service categories, such as voice POTS, voice long distance, data and video. One possible use of this method would involve assigning no more cost to the basic POTS classification than can be identified as necessary under "stand-alone" attribution, the cost of providing POTS alone, independent of the provision of other services.

Another suggested solution for this issue is for the regulatory commissions to defer capital recovery for those investments that can be attributed to future benefitted service categories.

This rate making question presents immediate cost allocation questions for services such as intelligent network services which require the new signaling system (SS7).

E. Outline of the Report

The remainder of the report is divided into two chapters. Chapter II deals with the historical example of long distance service impacting local exchange plant. Chapter III deals with the current round of technological innovation associated with "information age" services. Each chapter will follow the model outlined in Table I-1, whereby technological change is viewed as a response to the technical requirements of new services, and regulators' allocation of costs, and the resulting price changes, associated with technological change.

Within each chapter an effort is made to keep technical discussions to a minimum. More technical discussion is provided in an appendix at the end of the chapter for those interested in a greater level of technical detail.

ATTACHMENT 3

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Implementation of the Local Competition	)	
Provisions in the Telecommunications Act	)	CC Docket No. 96-98
of 1996	)	

COMMENTS OF
CONSUMER FEDERATION OF AMERICA (CFA) AND CONSUMERS UNION (CU)

Bradley C. Stillman, Esq.
Telecommunications Policy Director

Dr. Mark N. Cooper
Research Director

Consumer Federation of America
1424 16th Street, N.W.
Washington, DC 20036

Counsel for
Consumer Federation of America and
Consumers Union

May 16, 1996

III

THE PROBLEM OF PRICING TO PROTECT CAPTIVE RATEPAYERS IN A MULTI-PRODUCT, MIXED COMPETITIVE/MONOPOLY ENVIRONMENT

A. THE IMPORTANCE OF HISTORY: THE ECONOMIC VALUE OF THE LOCAL MONOPOLY

In choosing a cost standard, the FCC must not underestimate the impact of decades of franchise monopoly status. As previously stated, this monopoly in local telecommunications services has resulted in a large number of factors that prevent competitors from entering the local telephone market. These range from legal prohibitions, to economic obstacles, to public policy barriers. This protected monopoly history has an immense impact on economic structures on a going-forward basis.

Just like the farmer who inherits the most fertile land at the mouth of the delta of a river, the local telephone companies have inherited their position. The farmer reaps the windfall of lower cost (e.g. no need to irrigate, less need to fertilize and lower transportation costs) as a right of ownership. The ground rents associated with public utility rights of way, however, properly belong to the public. The FCC must not allow incumbents to capture these ground rents as excess profits in the transition to a multi-product, competitive firm. Most importantly, these rents must not be allowed to confer a cost advantage on the incumbents, enabling them to frustrate competition.

The local exchange company serves markets which cover a much broader range of demand elasticities than those of any potential entrant. No potential entrant possesses a core market with anything near the extremely low elasticity of demand of residential telephone service, to which the vast majority of the incumbent's shared (joint and common) costs can be allocated. As a result, if permitted, the local companies can strategically allocate costs to frustrate competition. New entrants whose incremental costs are lower for specific services could be prevented from entering the marketplace because the incumbent is strategically allocating shared costs (joint and common costs) to prevent that entry. By treating the less competitive residential sector as a core from which a disproportionately large portion of shared costs (including loop as Congress intended) are recovered, the company can then price its competitive services below their total service long run incremental costs (TSLRIC), forestalling entry of competitors.

B. THE POTENTIAL FOR CROSS-SUBSIDY AND ANTI-COMPETITIVE PRICING

1. Cross Subsidy and Other Cost Advantages

The presence of sunk costs and the failure to properly deal with future efficiencies creates a serious risk of anti-consumer anti-competitive pricing. The potential for massive cross-subsidy in the integrated telecommunications firms should not be underestimated. CFA and CU believe recognition of the depth of the potential problems of cross-subsidy is the key to enacting pricing policies which will lead to effective local competition. The local exchange companies intend to build a high capacity network which will commingle hardware (facilities) and software (expertise and resources) between monopoly and competitive services spanning a number of sectors within the industry including local and long distance telephone and video at a minimum.

That there will be shared costs (joint and common costs) is inevitable. The expertise to be shared would include facilities, personnel and software for routing traffic, billing, operations support systems including traffic management, planning and engineering, to name just a few functions. Many of these managerial functions could be performed on a centralized basis. Indeed, we have witnessed a strong trend in the industry toward centralizing functions. Initial and ongoing transactions between regulated and unregulated, telco and non-telco components of the companies will abound.

Moreover, the problem of protecting the public and competition goes far beyond the issue of cross-subsidy. There are vast cost advantages that the franchise monopolist enjoys as a result of adding new businesses to its core monopoly. The existence of these cost advantages raises a fundamental question of whether stockholders or ratepayers have a claim on them and how they will impact on the competitive marketplace.

If facilities have been or are being paid for by ratepayers, then ratepayers have a claim on them. For example, fiber optic trunks and loops now being deployed by local exchange companies are vastly under-utilized. That excess capacity, which is being paid for by ratepayers, will be used to provide dialtone, data transmission, video and other services. Astonishingly, some LECs have asserted that *none* of the costs of fiber should be attributed to services other than dialtone. This flies in the face of the principle that those who reap the benefits should pay the costs.

Moreover, competitors of the LECs do not have access to such "free" facilities since they lack captive ratepayers. Hence, they would immediately be placed at a competitive disadvantage. The FCC surely would not want to permit overcharging of captive ratepayers to facilitate entry into other businesses. Indeed, we believe such a policy would be illegal under the 1996 Act.[13] Perhaps the clearest statement of this anti-competitive approach to deploying an advanced network was made in internal BellSouth papers.[14] This document described how the costs of delivering competitive services would be shifted onto telephone ratepayers by recovering all the joint and common costs from telephony

> This offers [1] the opportunity to cover the fixed costs of providing fibre to the home with POTS revenue and selling CATV transport to overbuilder, entrenched CATV operator and pay service vendor (HBO, etc.) alike at probably market prices well in excess of incremental costs. At that time, [2] profit or rate-of-return regulation should have evolved to price regulation either by the current set of state and federal regulators or by the market itself. [3] This means BellSouth will be able to keep its CATV transport profits despite the relative low level of incremental cost required to provide the service
>
> Having become "The Guy Who Got Fiber To the Home First", BellSouth's ubiquitous CATV transport will provide the "critical mass" necessary to support transport of the entire spectrum of BISDN services provided by the ESPs [Enhanced Service Providers]. Given the relative low incremental cost of "mining" more of fiber's huge bandwidth capacity to transport the wide variety of BISDN services and the pent-up demand signaled by the McKinsey study, BellSouth's BOCs' profit potential appears good

In this case, competitive services may cover their incremental costs, which means that the minimum cross-subsidy prevention standard may be met, but it does not adequately protect consumers, because they receive none of the benefits of the utilization of excess capacity for which they are paying. It does not adequately protect competitors because they are placed at

---

[13] §254(k). "Subsidy of Competitive Services Prohibited.--A telecommunications carrier may not use services that are not competitive to subsidize services that are subject to competition. The Commission, with respect to interstate services, and the States, with respect to intrastate services, shall establish any necessary cost allocation rules, accounting safeguards, and guidelines to ensure that services included in the definition of universal service bear no more than a reasonable share of the joint and common costs of facilities used to provide those services."

[14] Memo from R.T. Burns Assistant Vice President to N. C. Baker, Senior Vice President on "CATV Transport: Catalyst for BISDN", BellSouth Services, June 14, 1988, p. 10.

a cost disadvantage which has its origins in the monopoly franchise, not the competitive marketplace.

In the example given above, there may or may not technically be a cross-subsidy; the line is difficult to draw. If the cost of the excess capacity could have been avoided, then there is a cross-subsidy (telephone subscribers are paying more than the least cost, stand- alone service costs of a well-engineered network). If excess capacity could not have been avoided, due to the fact that capital is lumpy and the excess capacity occurred in the pursuit of the least cost technology, there may be no pure economic cross-subsidy. In either case, however, the consumers who paid for the network investments through general rates should share in the benefits of increased revenues that will be generated in the form of reduced future rates for local service.

2. Economic Coercion

Even if no technical cross-subsidy exists, there is still a serious problem of economic coercion -- ratepayers receiving no benefits from economies of scale and scope, even though they bear costs, and competitors placed at an unfair disadvantage because they have no access to those economies. Proper cost and price analysis is essential in order to prevent these problems and get to competition.

Current cost allocators do not capture the cost causal nature of the deployment of a radically different technology. Because competitive services and advanced functionalities are the drivers on the information superhighway, these allocators will certainly underestimate the share of costs that should be imputed to competitive services.

Suppose that, on a cost causative basis, the cost of functionality should be split 4:1

between competitive and utility services. For example, suppose a broadband network requires five times as many remote distribution units as a narrowband network. Suppose that the expense allocator is only 2:1. A competitor who must deploy four remote distribution units to deliver broadband network service will confront the telephone company, which has attributed the cost of only 2.5 remote units to its broadband services. The competitor will be at a disadvantage compared to the incumbent who has shifted costs onto captive ratepayers.

As long as there are joint and common costs with some lines of business above the line (regulated) and others below it (unregulated), there is always an incentive to put costs above the line and profits below, particularly in the period leading up to the setting of the price cap. In addition, price cap regulation does not alter this incentive for services which are not subject to the cap. It may increase its overall profits by shifting some costs to the monopoly side in order to achieve a higher market share and higher profits in the unregulated lines of business.

Nor does the local exchange company need to recover costs shifted onto utility ratepayers on a going-forward basis to achieve a competitive advantage. If the allocation of sunk costs does not reflect proper cost causation, the damage will have been done. Price caps do not eliminate this incentive either. To the extent that the regulator fails to properly pull costs into the competitive jurisdiction, the productivity performance of the utility operations will be artificially depressed. Productivity adjustments will be too low and monopoly local rates will be higher than they should be.

Even on a going-forward basis, price caps do not adequately promote competition or protect consumers where shared costs are large. Potential cost savings that result from the integration of utility and competitive services have not been reflected in the productivity gains in the past. To the extent that future productivity offsets do not reflect the gains uniquely associated with additional economies of scale and scope on the integrated network, this is a windfall to the incumbent local exchange carrier.

Congress recognized the important problem of economic coercion and adopted clear language to prevent it in Section 254(k). Basic service can bear, at most, a reasonable share of joint and common costs.